REMARKS

Summary of the Office Action

Figures 1-4 were objected to for not having a "Prior Art" legend because that which is old is illustrated.

Claims 1-12 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter of the invention.

Claims 1-12, 17, 18, 25-27, 32-34, and 39-45 were rejected under 35 U.S.C. § 102(b) as being anticipated by Scifres et al. U.S. Patent No. 5,103,456 (hereinafter "Scifres").

Claims 13-16, 28, 29, 35, and 36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Scifres in view of Spaeth et al. U.S. Patent No. 5,875,205.

Summary of Applicants' Response

Applicants have amended claims 1, 3, 6-8, and 13-20 to more clearly point out and distinctly claim the subject matter of their invention.

Applicants respectfully submit that the amendments traverse the rejections under 35 U.S.C. § 112, second paragraph, 35 U.S.C. § 102(b) and under 35 U.S.C. § 103(a) and respectfully submit that the application is in condition for allowance.

Reply to Rejections Under 35 U.S.C. § 102(b)

Applicants respectfully submit that Scifres fails to disclose, teach, or suggest the claimed inventions.

Scifres discloses a high-power, master-oscillator-power-amplifier ("MOPA") semiconductor laser device having a "laser diode oscillator" (Abstract) and "coupling grating disposed to deflect light at an angle from the laser oscillator" (Abstract). As described in Scifres, the coupling grating in the high-power semiconductor laser device has gratings of specific periods and angles relative to the laser stripe axis to deflect laser light ***"in the laser plane"*** to coherently couple neighboring devices together to achieve high total output power. "The orientation angle and grating period of the coupling grating are chosen to minimize feedback from the amplifier into the laser" (Abstract).

Specifically, Scifres shows in Fig. 8 the "top view" of the device with arrows indicating that the light propagation directions are on the laser plane. Fig. 8 further shows that the gratings near the AR-coated facet diffract the light to the output facet ***on the side(s) of the device***.

In contrast, the present invention is directed to semiconductor laser devices that are designed to emit light ***perpendicularly to the laser plane***. The semiconductor laser device has a lasing cavity that "emits a light beam propagating in a horizontal direction" (claim 1) into a "beam-deflecting section comprising a plurality of reflective surfaces arranged in an array for redirecting said horizontally-propagating light beam to propagate in a substantially vertical direction" (claim 1) perpendicular to the laser plane. This design is far more suitable for surface-emitting lasers in terms of its performance, manufacturing and packing density than the design

disclosed in Scifres, which primarily works for very high power side-emitting lasers.

Scifres does not disclose, teach, or suggest having a semiconductor laser device that emits light perpendicularly to the laser plane with a "beam-shaping micro-optics lens" (Abstract) that "collimates the vertically propagating redirected light beam to generate an output beam emitted from the top surface of the laser device" (Abstract).

As noted in Scifres, "for best output coupling the grating grooves should be made approximately perpendicular to the light propagation direction and the output coupling grating should be detuned to avoid feedback to the amplifier (col. 7, lines 21-25). However, even if a surface grating coupler is used in the design disclosed in Scifres, one can not correct or improve the quality of the surface-emitting beam profile by adding an on-chip lens or "a plurality of reflective surfaces arranged in an array" (claim 1). This is due to the facts that the grating coupled beam has high astigmatism (since gratings only affect the beam profile along one of two axes) and that there is not enough space to establish the required optical path length for any on-chip lenses to function properly.

Therefore, applicants respectfully submit that Scifres fails to anticipate claims 1-12, 17, 18, 25-27, 32-34, and 39-45, and claims which depend therefrom. Since Scifres fails to anticipate the claimed inventions of claims 1-12, 17, 18, 25-27, 32-34, and 39-45, applicants respectfully submit that claims 1-12, 17, 18, 25-27, 32-34, and 39-45 and their respective dependent claims, distinguish from, and are allowable over, the cited reference.

Reply to Additional Rejections Under 35 U.S.C. § 103(a)

Applicants respectfully submit that the combination of Scifres and Spaeth fails to render obvious the claimed invention.

"A claimed invention is unpatentable if the differences between it and the prior art 'are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art.'" 35 U.S.C § 103(a); *Graham v. John Deere Co.*, 383 U.S. 1, 14 (1965). Measuring a claimed invention against the standard established by section 103 requires the oft-difficult but critical step of casting the mind back to the time of the invention, to consider the thinking of one skilled in the art, guided only by the prior art references and the then-accepted wisdom in the field. *W.L. Gore & Assoc., Inc. v. Garlock, Inc.* 721 F.2d 1540, 1553.

The best defense against the subtle but powerful attraction of hindsight-based obviousness analysis is a rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references. There must be a clear and particular showing based on actual evidence of a teaching, suggestion, or motivation to make the cited combination. *C.R. Bard, Inc. v M3 Sys., Inc.*, 157 F.3d 1340,1352 (Fed. Cir. 1998). Broad statements regarding the teachings of multiple references standing alone are not evidence.

The Examiner has suggested that the combination of the elements in Scifres and Spaeth would render the claimed invention obvious. Applicants respectfully disagree and submit

that there is no suggestion in the art that the referenced components should be combined to provide a "semiconductor laser device" (claim 1) having "a laser cavity that emits a light beam propagating in a horizontal direction" (claim 1) into a "beam-deflecting section comprising a plurality of reflective surfaces arranged in an array for redirecting said horizontally-propagating light beam to propagate in a substantially vertical direction" (claim 1) perpendicular to the laser plane.

As discussed above with reference to Scifres, integrating a light deflector with a lens is not just a matter of fabrication technology, it requires unique designs that can provide a sufficient distance between the laser diode and the lens to assure the proper function of the lens. There is no suggestion or motivation to combine the design in Scifres with the design in Spaeth to provide "surface-emitting laser devices with integrated beam-shaping optics" (page 7, lines 12-13) that minimize "the need for external beam-shaping or focusing optics" (page 10, lines 5-6).

More specifically, Spaeth clearly shows in Fig. 1 the relation of the sizes and dimensions between the laser and the lens in the disclosed laser design. Laser diode 1 in Fig. 1 of Spaeth has the same dimension as the laser diode of the present invention shown in Figs. 5a-c and Figs. 6a-b, typically between 200 μm to 1 mm. However, in order for Spaeth's design to work, the relative size of lens chip 6 in Fig. 1 has to be many (5 to 10) times larger than the lenses in any of the designs disclosed in the present invention in Figs. 5a-c and Figs. 6a-b.

The main reason behind the lens size discrepancy between the design disclosed in the present invention and the design disclosed in Spaeth is that in the present invention the light travels a round-trip through the thickness of the laser substrate, which is transparent for infrared light, before reaching the lens. This establishes the optical path length and the beam spot size for the lens to function properly. In contrast, in Spaeth's design, the laser beam, once leaving the facet, travels in the air so that the lens surface has to be far enough from the laser to establish the optical path. The results are that Spaeth's design requires a much bigger lens (typically 5-10 times larger than our design) and the integration between lenses and lasers can only be done through an assembly process, rather than being formed ***directly*** on the laser chip using microfabrication process as in our invention.

Neither Scifres nor Spaeth discloses "surface-emitting laser devices with integrated beam-shaping optics" (page 7, lines 12-13), and it would be sheer hindsight to suggest that, even if the references could be combined, that this feature would somehow be suggested. Applicants therefore submit that the pending claims, as amended, patentably distinguish over the cited references.

Conclusion

In view of the above amendments and remarks, applicants respectfully submit that the present application is in condition for allowance, and respectfully request the same.

Respectfully submitted,

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